

Application No. 10/628,936
Response to Office Action

Customer No. 01933

R E M A R K S

Reconsideration of this application, as amended, is respectfully requested.

ALLOWABLE SUBJECT MATTER

The Examiner's allowance of claims 10-16 and the Examiner's indication of the allowability of the subject matter of claims 2-5, 7-9 and 19-21 are respectfully acknowledged.

Claims 2-5, 7-9 and 19-21, however, have not been rewritten in independent form at this time since, as explained in detail hereinbelow, it is respectfully submitted that their parent claims 1 and 17 also recite allowable subject matter.

THE CLAIM AMENDMENTS

Claims 1-4, 6-12 and 14-22 have been amended only to make some minor grammatical improvements and to correct some minor antecedent basis problems so as to put the claims in better form for issuance in a U.S. patent.

No new matter has been added, and it is respectfully requested that the amendments to claims 1-4, 6-12 and 14-22 be approved and entered.

It is respectfully submitted, moreover, that the amendments to the claims are not related to patentability, and do not narrow

Application No. 10/628,936
Response to Office Action

Customer No. 01933

the scope of the claims either literally or under the doctrine of equivalents.

THE PRIOR ART REJECTION

Claims 1, 6, 17 and 18 were rejected under 35 USC 102 as being anticipated by USP 6,312,077 ("Araki"), and claim 22 was rejected under 35 USC 103 as being obvious in view of the combination of Araki and USP 5,625,393 ("Asai"). These rejections, however, are respectfully traversed.

According to the present invention as recited in claim 1, before an ink droplet jetting operation is conducted and without jetting an ink droplet, an ink meniscus in the nozzle is vibrated finely by performing a plurality of times: (i) a pushing out process of pushing the ink meniscus out from a surface of the nozzle such that a peak distance of the ink meniscus from the surface of the nozzle is at least substantially equal to a radius of the nozzle, and (ii) a pulling process of pulling in the ink meniscus into the nozzle toward the ink channel past a repose position of the ink meniscus.

That is, according to the present invention as recited in claim 1, the vibration of the ink meniscus takes place before the jetting operation and without jetting an ink droplet. In addition, according to the present invention recited in claim 1,

Application No. 10/628,936
Response to Office Action

Customer No. 01933

the pushing out and pulling in processes are performed a plurality of times.

With this structure, the vibration of the ink meniscus promotes movement of the ink to stir the ink and control the difference in viscosity between the ink near the nozzle and the ink in the ink channel, and the decapping characteristic of the nozzle is improved. As described in the specification on page 28, lines 2-19, the decapping characteristic is particularly improved since the pushing out and pulling in processes are performed a plurality of times.

Similarly, according to the present invention as recited in independent claim 17, fine vibration of the ink meniscus in the nozzle is conducted without causing an ink droplet to be jetted, in which the ink meniscus is pushed out from a surface of the nozzle by a peak distance at least substantially equal to a nozzle radius.

The Examiner contends that Figs. 10(a), 10(b) and 10(c) of Araki show fine vibration of the ink meniscus as according to the present invention as recited in independent claims 1 and 17.

It is respectfully submitted, however, that Araki does not disclose finely vibrating the ink meniscus before an ink jetting operation and without causing an ink droplet to be jetted. And it is respectfully submitted that Araki clearly does not disclose that the fine vibration process is repeatedly performed.

Application No. 10/628,936
Response to Office Action

Customer No. 01933

In fact, it is respectfully pointed out that Figs. 10(a)-10(g) Araki show the ink meniscus during an ink ejection operation for obtaining a high speed droplet ejection. Thus, Fig. 10(a) of Araki shows that the meniscus is flattened before the ejection operation; then as shown in Fig. 10(b) a contraction signal is applied at time T1; then, as shown in Fig. 10(c) a first expansion signal is sent to abruptly expand the pressure generation chamber 11 to discharge an ink droplet; then as shown in Fig. 10(d) the ink discharge speed is further increased by contraction of the pressure generation chamber.

Thus, it is respectfully submitted that Fig. 10 of Araki clearly shows a discharge operation, in which an ink droplet is discharged such that a wide range of sizes of ink droplets can be discharged during gradation printing with high speed, low voltage and high repetition frequency.

Accordingly, it is respectfully submitted that Fig. 10 of Araki does not at all relate to a vibration operation that takes place before an ink droplet jetting operation is conducted and without jetting an ink droplet, in which the ink meniscus in the nozzle is vibrated finely by performing vibration processes a plurality of times. In addition, it is respectfully pointed out that Araki discloses that an ink droplet is discharged when the meniscus is expanded (see column 17, lines 57-64 of Araki). Thus, it is respectfully submitted that Araki does not disclose

Application No. 10/628, 936
Response to Office Action

Customer No. 01933

vibrating the meniscus without discharging an ink droplet, in which the meniscus is pushed out from the nozzle.

Accordingly, it is respectfully submitted that Araki clearly does not disclose, teach or suggest the features of the present invention recited in independent claim 1 whereby before an ink droplet jetting operation is conducted and without jetting an ink droplet, an ink meniscus in the nozzle is vibrated finely by performing a pushing process and a pulling process a plurality of times.

And it is respectfully submitted that Araki does not at all disclose teach or suggest the feature the present invention recited in independent claim 17 whereby fine vibration of the ink meniscus in the nozzle is conducted without causing an ink droplet to jet, in which the ink meniscus is pushed out from a surface of the nozzle by a peak distance at least substantially equal to a nozzle radius.

In view of the foregoing, it is respectfully submitted that independent claims 1 and 17, as well as claims 6, 18 and 22 and allowable claims 2-5, 7-9 and 19-21 respectively depending therefrom, all clearly patentably distinguish over Araki, taken singly or in combination with any of the other cited references, under 35 USC 102 as well as under 35 USC 103, along with allowed claims 10-16.

Application No. 10/628,936
Response to Office Action

Customer No. 01933

Entry of this Amendment, allowance of the claims and the passing of this application to issue are respectfully solicited.

If the Examiner has any comments, questions, objections or recommendations, the Examiner is invited to telephone the undersigned at the telephone number given below for prompt action.

Respectfully submitted,



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